DNI NEVADA

Operating Manual

Model 402A

Electrosurgical Analyzer

DNI NEVADA

Model 402A
Electrosurgical Analyzer
Operating Manual

© 1998 DNI Nevada, Inc.
2000 Arrowhead Drive
Carson City, NV • U.S.A. • 89706-0403
tel 702.883.3400 • fax 702.883.9541
e-mail **sales@dninevada.com**

DNI NEVADA
INCORPORATED

To order this manual, use part number 9508-0284.

Revision History		
Revision	Description	Date
A	Initial Release	8/98

Copyright

DNI Nevada agrees to a limited copyright release that allows you to reproduce manuals and other printed materials for use in service training programs and other technical publications. If you would like other reproductions or distributions, submit a written request to DNI Nevada, Inc.

Unpacking and Inspection

Follow standard receiving practices upon receipt of the instrument. Check the shipping carton for damage. If damage is found, stop unpacking the instrument. Notify the carrier and ask for an agent to be present while the instrument is unpacked. There are no special unpacking instructions, but be careful not to damage the instrument when unpacking it. Inspect the instrument for physical damage such as bent or broken parts, dents, or scratches.

Claims

Our routine method of shipment is via common carrier, FOB origin. Upon delivery, if physical damage is found, retain all packing materials in their original condition and contact the carrier immediately to file a claim.

If the instrument is delivered in good physical condition but does not operate within specifications, or if there are any other problems not caused by shipping damage, please contact DNI Nevada or your local sales representative.

Standard Terms and Conditions

Refunds & Credits

Please note that only serialized products (products labeled with a distinct serial number) and accessories are eligible for partial refund and/or credit. Nonserialized parts and accessory items (cables, carrying cases, auxiliary modules, etc.) are not eligible for return or refund. In order to receive a partial refund/credit of a product purchase price on a serialized product, the product must not have been damaged by the customer or by the common carrier chosen by the customer to return the goods, and the product must be returned complete (meaning all manuals, cables, accessories, etc.) within 90 days of original purchase and in "as new" and resellable condition. The Return Procedure must be followed to assure prompt refund/credit.

Restocking Charges

Only products returned within 90 days from the date of original purchase are eligible for refund/credit. Products returned within 30 days of original purchase are subject to a minimum restocking fee of 15%. Products returned in excess of 30 days after purchase, but prior to 90 days, are subject to a minimum restocking fee of 20%. Additional charges for damage and/or missing parts and accessories will be applied to all returns. Products not returned within 90 days of purchase, or products which are not in "as new" and resellable condition, are not eligible for credit return and will be returned to the customer.

Return Procedure

Every product returned for refund/credit must be accompanied by a Return Material Authorization (RMA) number, to be obtained from our Order Processing Department. All items being returned must be sent freight prepaid to our factory location.

Certification

This instrument was thoroughly tested and inspected and found to meet DNI Nevada's manufacturing specifications when it was shipped from the factory. Calibration measurements are traceable to the National Institute of Standards and Technology (NIST). Devices for which there are no NIST calibration standards are measured against in-house performance standards using accepted test procedures.

Warranty

Warranty and Product Support

This instrument is warranted by DNI Nevada against defects in materials and workmanship for one full year from the date of original purchase. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product, shipping prepaid, to DNI Nevada, Inc. This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than DNI Nevada. IN NO EVENT SHALL DNI NEVADA BE LIABLE FOR CONSEQUENTIAL DAMAGES.

Only serialized products and their accessory items (those items bearing a distinct serial number tag) are covered under this one–year warranty. PHYSICAL DAMAGE CAUSED BY MISUSE OR PHYSICAL ABUSE IS NOT COVERED UNDER THE WARRANTY. Items such as cables and nonserialized modules are not covered under this warranty.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state, province to province, or country to country. This warranty is limited to repairing the instrument to DNI Nevada's specifications.

When you return an instrument to DNI Nevada, Inc., for service, repair, or calibration, we recommend using United Parcel Service, Federal Express, or Air Parcel Post. We also recommend that you insure your shipment for its actual replacement cost. DNI Nevada will not be responsible for lost shipments or instruments that are received in damaged condition due to improper packaging or handling. All warranty claim shipments must be made on a freight prepaid basis. Also, in order to expedite your claim, please include a properly completed copy of the Service Return Form. Recalibration of instruments, which have a recommended semiannual calibration frequency, is not covered under the warranty.

Use the original carton and packaging material for shipment. If they are not available, we recommend the following guide for repackaging:

- Use a double–walled carton of sufficient strength for the weight being shipped.
- Use heavy paper or cardboard to protect all instrument surfaces. Use nonabrasive material around all projecting parts.
- Use at least four inches of tightly packed, industrial–approved shock–absorbent material around the instrument.

Warranty Disclaimer

Should you elect to have your instrument serviced and/or calibrated by someone other than DNI Nevada, please be advised that the original warranty covering your product becomes void when the tamper-resistant Quality Seal is removed or broken without proper factory authorization. We strongly recommend, therefore, that you send your instrument to DNI Nevada for factory service and calibration, especially during the original warranty period.

In all cases, breaking the tamper-resistant Quality Seal should be avoided at all cost, as this seal is the key to your original instrument warranty. In the event that the seal must be broken to gain internal access to the instrument (e.g., in the case of a customer-installed firmware upgrade), you must first contact DNI Nevada's technical support department at 702-883-3400. You will be required to provide us with the serial number for your instrument as well as a valid reason for breaking the Quality Seal. You should break this seal only after you have received factory authorization. Do not break the Quality Seal before you have contacted us! Following these steps will help ensure that you will retain the original warranty on your instrument without interruption.

WARNING

Unauthorized user modifications or application beyond the published specifications may result in electrical shock hazards or improper operation. DNI Nevada will not be responsible for any injuries sustained due to unauthorized equipment modifications.

Table of Contents

1 General Information

Safety Considerations 1
Introduction 2
Statement of Intended Use 2
Using This Manual 2
Applicable Testing Standards 3

2 Specifications

Instrument Specifications 5
General Specifications 8
Accessories 9

3 Instrument Familiarity

4 Installation

Setting up the Model 402A 15
Power-Up Sequence 16
Power-Up Error Condition Codes 17
Fuses 18
Internal Fuse 18
External Fuses 19
Ventilation 21
Connecting Test Leads between the ESU and the Analyzer 22
ESU- Active Safety Lead 22
ESU- Dispersive Safety Lead 22
ESU Jumper Safety Lead 23
ESU CQM Safety Lead 23

5 Manual Operation

Safety Precautions 25
Performing Manual Tests 27
Performing the Generator Output Test 28
Performing the HF Leakage Current Test 1 32
Performing the HF Leakage Current Test 2 35
Performing the HF Leakage Current Test 3 38
Performing the Basic Contact Quality Monitor (CQM) Test 42
Connecting an Oscilloscope to the Model 402A 45

6 Remote Operation

Simplex Mode 48
Duplex (Remote) Mode 51
How to Make a Remote Connection 51
Duplex Mode Characteristics 52
How to Enter Commands 53
Responses to Commands 53
medTester 5000C Autosequence Operation 57

Index 63

Abbreviations

ANSI	American National Standards Institute
A	ampere
AAMI	Association for the Advancement of Medical Instrumentation
BPM	beats per minute
dB	decibel
°C	degrees Celsius (centigrade)
°F	degrees Fahrenheit
DMM	digital multimeter
EEPROM	electrically erasable PROM
ECG	electrocardiograph or electrocardiogram
EUT	equipment under test
Hz	hertz
in	inch
k	kilo-(10^3)
kg	kilogram
kHz	kilohertz
kΩ	kilohm
LED	light-emitting diode
LCD	liquid crystal display
M	meg(a)-(10^6)
MHz	megahertz
MΩ	megohm

m	meter
µ	micro-(10^{-6})
µA	microampere
µV	microvolt
m	milli-(10^{-3})
mA	milliampere
mm	millimeter
mV	millivolt
Ω	ohm
p-p	peak-to-peak
lb	pound
s	second
V	volt

Chapter 1

General Information

Safety Considerations

General

This instrument and related documentation must be reviewed for familiarization with safety markings and instructions before you operate the instrument.

Safety Symbols

This is the Operating Manual symbol. When you see this symbol on the instrument, refer to the Operating Manual.

This symbol indicates that a terminal is connected to the chassis when such a connection is not apparent.

Alternating current.

Direct current.

Earth ground

WARNING!

The ***WARNING!*** sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a ***WARNING!*** sign until the indicated conditions are fully understood and met.

CAUTION

The ***CAUTION*** sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument. Do not proceed beyond a ***CAUTION*** sign until the indicated conditions are fully understood and met.

Introduction

The Model 402A will test electrosurgical units (ESU) for generator output and high frequency (HF) leakage. It is compatible with both isolated and earth/ground-referenced types of electrosurgical units and will test both high-level monopolar and the low-level bipolar ESU outputs.

The Model 402A uses a precision high-voltage capacitive attenuator to sample the applied ESU signal. This attenuated HF voltage and the selected test load resistance value are used to derive the RMS value of the input voltage. This value is used to calculate current and power.

The Model 402A internal test load simulates the range of resistance encountered during surgical procedures. Additionally, a second, 200 ohm auxiliary test load resistance is built-in to analyze earth/ground-referenced ESUs as specified in the International Standard IEC 601-2-2.

Extraneous high frequency leakages within the analyzer are minimized due to the exclusive use of high-impact plastic material for the analyzer case.

Statement of Intended Use

The Model 402A is intended for use by a hospital's biomedical department, third-party service groups, and medical device manufacturers as a routine performance assurance and periodic maintenance analyzer of electrosurgical devices.

Using This Manual

The manual is written for the biomedical technician or clinical engineer having responsibilities for testing electrosurgical equipment for safety and performance.

Applicable Testing Standards

The Model 402A has been tested by an independent laboratory and meets the requirements listed here.

Safety Requirements

USA	UL 3101-1, Electrical Equipment for Laboratory Use; Part 1: General Requirements.
Canada	CAN/CSA C22.2 No. 1010–1 (1992), Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements.
International	EN-61010–1 (1993) Safety requirement for electrical equipment for measurement, control and laboratory use, Part 1: General Requirements.
EC Directive	73/23/ EEC EN 61010–1, Safety requirement for electrical equipment for measurement, control and laboratory use, Part 1: General Requirements.

Electromagnetic Interference and Susceptibility Requirements

- 89/336/EEC Directive for EMC
- Group 1, Class A

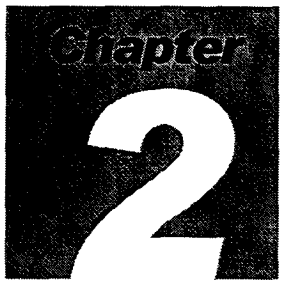
The Model 402A is intended to operate within these limits:

- USA: FCC class A
- Canada: Canadian Department of Communications, Class C

Technical Requirements

This section lists reference documents for high frequency, surgical equipment inspection.

ANSI / AAMI HF–18-1986	American National Standard for Electrosurgical Devices.
IEC 601 2–2	Medical Electrical Equipment, Part 2: Particular requirements for the safety of high-frequency surgical equipment.
IEC 1289-1	Technical Report-Type 3: High-frequency surgical equipment, Part 1, Operation.
IEC 1289-2	Technical Report-type 3: High-frequency surgical equipment, Part 2, Maintenance



Specifications

Instrument specifications, general specifications, and Model 402A accessories are listed in this chapter.

Instrument Specifications

Parameter	Specification/Accuracy
Modes of Operation	• Manual • Remote (via the serial port to a controller) *Simplex:* Fixed string of test data transmitted from the 402A (via push button) to the host device. *Duplex:* Remotely controlled. Test data requested by host device.
Displayed Parameters	• Power (watts) • RF Current (milliamperes) • Test Load (ohms)
Tests Performed	• Generator Output • HF Leakage Performs HF leakage tests to IEC 601 2–2, 1289–2, ANSI/AAMI standards: *Type BF Test 1*—Earth referenced monopolar output *Type BF Test 2*—Earth referenced monopolar output *Type CF / Bipolar*—Isolated monopolar or bipolar output
Measurement	• Technique: Precision high-voltage capacitive attenuator samples applied ESU signal. This directly measured HF voltage and the selected test load resistance value utilized to derive the RMS value of the current and calculate power.

Parameter	Specification/Accuracy
	• HF Power (watts): Range: 1 to 400 w Resolution: 0.1 w Maximum average power input: 400 w RMS Accuracy: ±5% of reading or ±3 watts, whichever is greater.
	• HF Current Range: 30 to 2500 mA RMS, Resolution: 1 mA Accuracy: ±2.5% of reading or ±15 mA, whichever is greater.
Bandwidth/ System Response	• Bandwidth of RMS converter circuit (1% accuracy) *Flat response: 10 kHz to 10 MHz* *–3 dB points: 1 kHz to 20* MHz
	• System Response (measurement circuitry and selected test load: *–3 dB points: 1 KHz to 10 MHz @ 300 ohms*
Test Load Section	• Main Test Load *Selections:* 15 *Selection range:* 50 to 750 Ω *Step size:* 50 Ω *Duty cycle:* 50% @ 400 w (maximum 30 seconds ON during any one–minute period. *Resonance impedance variation:* ±0.5 dB maximum (<10 MHz) *Accuracy (DC to 500 kHz):* ±4% of selected value (across the entire operating temperature range).
	• Auxiliary Leakage Test Load *Fixed:* 200 Ω *Accuracy:* ±4%
	• Input Capacitance (nominal) *Active to Dispersive:* 30 pF *Active or Dispersive to Earth ground:* 40 pF

Parameter	Specification/Accuracy
Auxiliary Contact Quality Monitor Testing Feature	The main test load section is used to perform a simple Auxiliary Contact Quality Monitor (CQM) test.
Display	• Type: Red LED, 7–segment • Display Size: 4 full digits • Overall Display Size: 2.0" x 0.75"
Front–Panel Controls/Push buttons	• Measurement Select (1) • Load Select: Increment test load (+) one step (1) Decrement test load (–) one step (1)
Top–Panel Input Connections	• Designations: *Generator output–active (1)* *Generator output–dispersive (2)* *Signal earth/ground reference (2)* *Auxiliary HF leakage load (2)* • Connector type: *4–mm (0.160″) diameter safety sockets* • Input voltage limit: 10,000 V peak • Input current limit: 3 amperes RMS • Installation category II (per IEC 1010)
Serial Port	• Baud rate: 2400 fixed • Connector type: Male DB9
Oscilloscope Output	• Transformer coupled output • Scale Factor: uncalibrated • Connector Type: BNC
Calibration Period	Contact DNI Nevada for details.

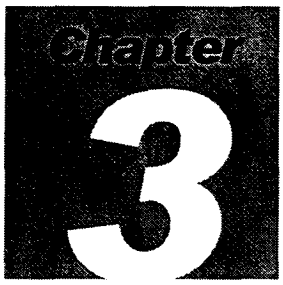
General Specifications

Parameter	Specification/Accuracy
Temperature Range	• Operating: 15° to 35°C • Storage: 0° to 50°C
Humidity Range	90% non–condensing
Altitude	To 2,000 M
Ventilation	• Internal fan with variable speed control • Over temperature protection • Optical tachometer sensor to detect blocked fan rotor
Power Requirements	• Universal input switching supply (12VDC output) • Operating voltages: *Specified: 115 VAC/230 VAC* *Maximum range: 83 to 264 VAC* • Operating frequencies: *Specified: 50 Hz/60 Hz* *Maximum range: 47 to 63 Hz* • Maximum input requirement: 40 VA • Fusing *External (user–replaceable):* *Quantity: 2* *250 V, 3.15 A, Type F, L1 and L2* *Internal (non user-replaceable):* *Quantity: 1* *250 V, 3.15 A, Type F, L1*
Case Construction	High–impact plastic, UL94-V0
Weight	5.6 kg (12.3 lb)
Dimensions	15.24 cm H × 34.24 cm W × 30.48 cm D (6.0″ H × 13.5″ W × 12.0″ D)
Intended Use	• Indoor • The following as referenced by IEC 1010 standard: • Installation category 2 • Pollution degree 2 • Portable equipment • Sound levels less than 65 dB A

Accessories

Standard		DNI Part #
402A Operating Manual		9508–0284
Test Leads:		
1. ESU-Active safety lead with alligator clip (quantity of 1)		3010–0579
2. ESU-Dispersive safety lead (1)		3010–0576
3. ESU-Jumper safety lead (2)		3010–0578
4. ESU-CQM safety lead (1)		3010–0575
Fuse:		
Type F, 3.15 A, 250 V		1005–0194
Detachable Power Cord Set (applicable one included with order):		
North America and Japan:		
USA/Canada/Japan (110V/10A operation)		3010–0055
International:		
European/Schuko	250 VAC 10 amp	3010–0014
Switzerland	250 VAC 10 amp	3010–0015
Australia	250 VAC 10 amp	3010–0016
United Kingdom	250 VAC 10 amp	3010–0017
Italy	250 VAC 10 amp	3010–0018
Denmark	250 VAC 10 amp	3010–0462
Old UK/India South Africa	250 VAC 10 amp	3010–0463
Israel	250 VAC 10 amp	3010–0465

		DNI Part #
Optional		
Serial Cable: medTester 5000C to Model 402A, or Personal Computer to Model 402A	DB9 Female to DB25 Female	**3010-0441**
Serial Cable: medTester 6000 to Model 402A, or Personal Computer to Model 402A	DB9 Female to DB9 Female (null modem)	**3010–0585**



Instrument Familiarity

This chapter familiarizes you with the 402A's control and interface panels, including the front panel, the top panel, the right panel, and the left panel.

The numbers in the list refer to the locations in Figure 3-1.

Front Panel Layout

1. **DISPLAY**—A numeric, 4-digit, red LED
2. **POWER INDICATOR LAMP**—Displays readings in watts.
3. **CURRENT INDICATOR LAMP**—Displays readings in milliamperes (mA).
4. **TEST LOAD INDICATOR LAMP**—Displays resistance readings in ohms.
5. **MEASUREMENT SELECTION PUSHBUTTON**—Toggles the display between **Power** (in watts) and **Current** (in mA).
6. **INCREASE TEST LOAD RESISTANCE PUSHBUTTON.**
7. **DECREASE TEST LOAD RESISTANCE PUSHBUTTON.**
8. **CARRYING HANDLE.**

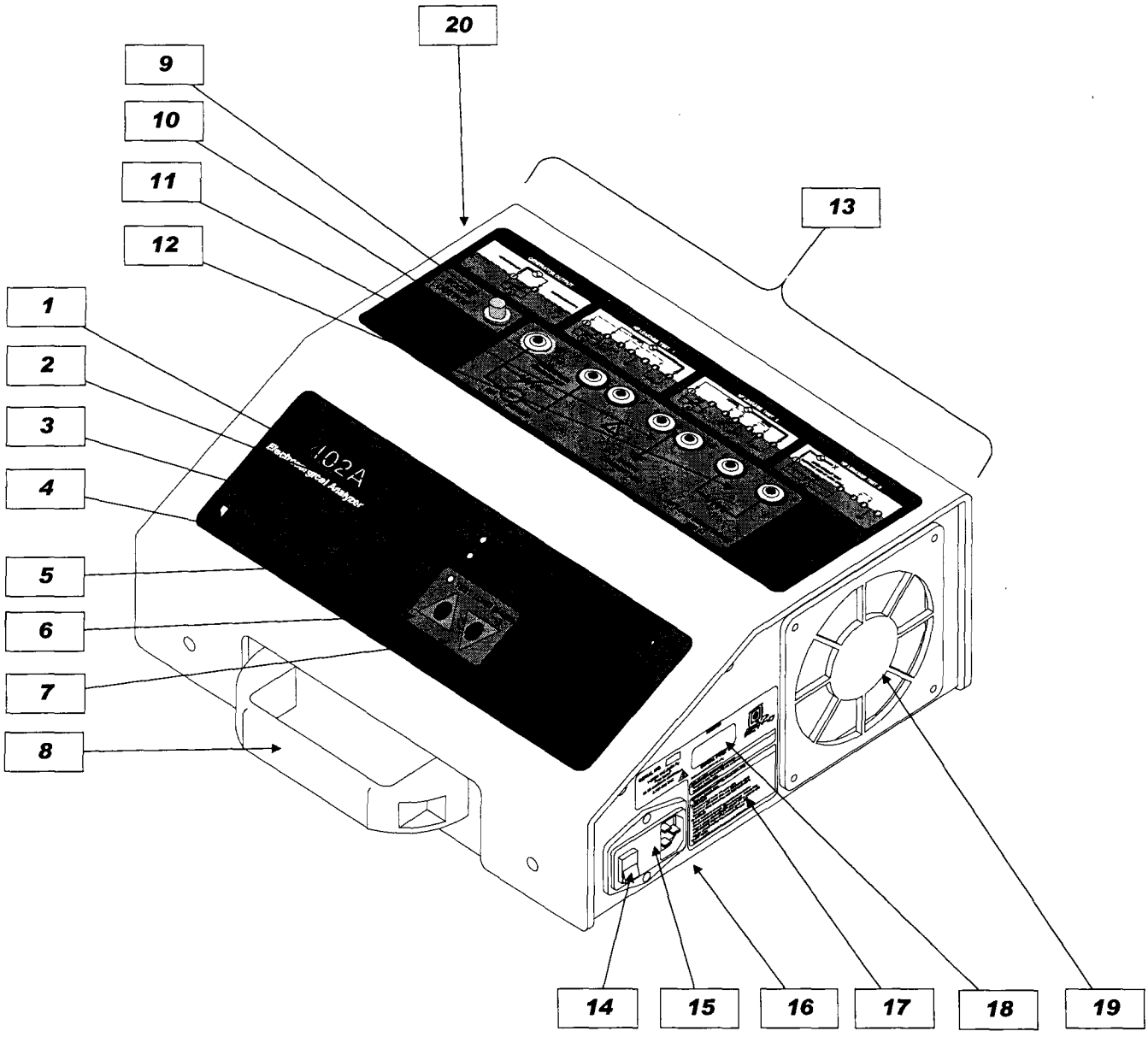


Figure 3-1. *Model 402A Control and Interface Panels*

Top Panel Layout

9. **SCOPE OUTPUT**—BNC connector.

10. **MEASURING RESISTANCE/HF METER**—All measurements made through this input.

11. **EARTH CONNECTIONS**—Provides earth reference for HF Leakage tests.

12. **HF LOAD RESISTANCE**—Auxiliary test load for earth/ground-referenced Type BF Tests 1 and 2.

13. **TEST BLOCK DIAGRAMS**—Provides a color-coded functional block diagram for each ESU test.

Right Panel Layout

14. **POWER ON/OFF SWITCH.**

15. **FUSE COVER**—Both power mains fuses are located behind this hinged panel.

16. **POWER CORD INLET.**

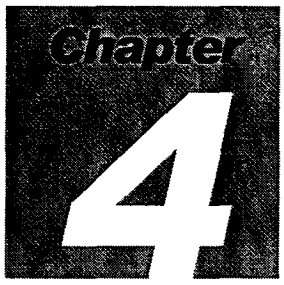
17. **SHORTFORM SERIAL PORT INSTRUCTIONS.**

18. **SERIAL PORT**—Provides a connection to the host controller or terminal.

19. **VENTILATION AIR OUTLET.**

Left Panel Layout

20. **VENTILATION AIR INLET.**



Installation

Use this chapter to learn how to use your Model 402A for testing electrosurgical units.

Setting up the Model 402A

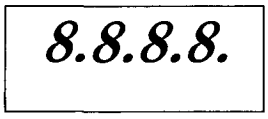
The Model 402A has a universal power supply and will automatically operate with applied mains voltages rated from 83 to 264 VAC. You do not need to adjust voltage via jumpers or programming tabs in order to operate the analyzer.

Set up the Model 402A for operation by attaching the supplied power cord to the power cord inlet located on the right panel of the analyzer case. If necessary, please refer to Chapter 3, *Instrument Familiarity*, for identifying the power cord inlet.

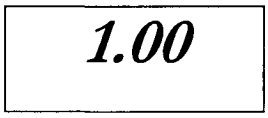
Power-Up Sequence

After plugging the Model 402A into a correctly rated and wired and grounded AC outlet, locate the power switch on the right panel. Move the switch to the *ON* position (marked with the | symbol). Next you should observe the following power-up sequence:

1. The three front LED indicator lamps illuminate, and you see this information momentarily appear in the display:



2. Next the installed version of the Model 402A's firmware briefly appears in the display. Here's an example:



   If the letter *E* followed by a number appears next, this indicates an error condition. See *Power-Up Error Condition Codes* below.

3. After the initialization is complete, the display is blank and the analyzer advances to its default test load condition of 300 ohms, ready to measure ESU power in watts.

Power-Up Error Condition Codes

If in Step 2 above you see the letter *E* followed by a number, this indicates that the Model 402A has detected a problem during its internal self-test. This table shows you all error condition code numbers that could appear in the display and the condition indicated by the code:

Model 402A Power-Up Error Condition Codes	
Code Number	**Error Condition Indicated**
E 03	EPROM checksum wrong
E 04	RAM bad
E 05	EEPROM checksum wrong
E 06	AC-to-DC power converter bad
E 07	RMS converter bad
E 08	Peak detectors bad
E 09	Temperature sensors bad

Note

If you see an error code, contact DNI Nevada technical support.

All Closed Jobs for Terumo in the Month of February

Problem No.	Company	Campus	Dept	Serial No.	Model	Asset Description	Fault Description	Open Time
PM158822	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	2002-170114		T RAC BATTERY	BATTERY BROKEN	18/03/2003 9:23
PM158823	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	2001-471633		T RAC BATTERY	NOT WORKING	18/03/2003 9:27
PM158824	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	2002-170112		T RAC BATTERY	DEAD BATTERY	18/03/2003 9:28
PM158825	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	2001-272108		T RAC BATTERY	NOT CHARGING - NOT WORKING	18/03/2003 9:33
PM158826	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	2002-170097		T RAC BATTERY	BATTERY NOT WORKING	18/03/2003 9:39
PM159735	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	9750901455		T-RAC BATTERY	CANNOT BE RECHARGED	01/04/2003 15:41
PM159736	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	2002-170881		T-RAC BATTERY	PINS IN SOCKET BROKEN	01/04/2003 15:42
PM159987	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	1101802		TUBE SEALER	NOT ADVANCING WAFER EVERYTIME	04/04/2003 13:38
PM159989	TERUMO AUSTI	0682/NORTH RYDE	-				SUPPLY FUSES	04/04/2003 14:03
PM160079	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	2030402		TUBE SEALER	WAFER ADVANCE VERY STIFF	07/04/2003 16:58
PM160375	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	98091024		TUBE WELDER	WAFER NOT BEING PICKED UP	11/04/2003 14:12
PM160643	TERUMO AUSTI	0682/NORTH RYDE	TERUMO CORPORATION	9704048		HEAT SEALER	LIGHT NOT FUNCTIONAL, MICROSWITCH NOT FUNCTION	16/04/2003 19:05
PM160932	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS - STH MELB	98060810		STERILE DOCKER	WAFER ERROR EVERY TIME IT IS REPLACED	23/04/2003 14:13
PM160934	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS - STH MELB	94120114		STERILE DOCKER	WAFER ERROR EVERY TIME IT IS REPLACED	23/04/2003 14:14
PM161045	TERUMO AUSTI	0682/NORTH RYDE	NORTH RYDE	2002-06011		STERILE DOCKER	WAFER REPLACEMENT LEVER EXTREMELY DIFFICULT T	24/04/2003 15:28
PM161046	TERUMO AUSTI	0682/NORTH RYDE	NORTH RYDE	71102		STERILE DOCKER	WAFER ARM VERY STIFF	24/04/2003 15:31
PM159845	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	98060810		TUBE SEALER	WAFER JAM	02/04/2003 16:57
PM159988	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	94120114		TUBE SEALER	WAFER JAMMED	04/04/2003 13:44
PM160074	TERUMO AUSTI	0682/NORTH RYDE	RED CROSS	950405C2		HEAT SEALER	START BUTTON DOES NOT ACTIVATE	07/04/2003 15:56

TOTAL NUMBER OF JOBS
19 Jobs were closed during the month of April

LOCATION OF JOBS
12 Jobs were booked in for Red Cross
2 Jobs were booked in for Terumo

AVERAGES
Average turnaround in days: 10.85
Average time: 1.75 hours
There was 1 job that was completed on site

ROUTINE SERVICES

There were no Routine Services for the month of February

HOURS LEFT
The number of hours left from the prepurchsed block of 100 is 35.25 hours.

Fuses

The Model 402A contains three (3) fuses:

- 1, internal, non operator-replaceable fuse, and
- 2, external, operator-replaceable fuses.

All fuses are rated as Type F, 3.15 A, and 250 V.

Internal Fuse

The internal fuse is located in the power supply. You can not replace this fuse.

Note

Do not attempt to replace the internal fuse. Return your Model 402A to DNI Nevada or to a factory authorized service center for replacement.

External Fuses

Each of the two incoming mains supply lines is protected by a separate fuse that you can access. You can replace one or both of these fuses by opening the fuse cover located on the right panel. If necessary, see Chapter 4, *Instrument Familiarity*, to identify the fuse cover. You can also refer to Figure 4-1, to see a diagram of the fuse cover assembly.

To replace an external fuse:

1. Disconnect the power cord, and make sure that the power switch is in the *OFF* position. Power is now safely removed from the analyzer.
2. Pry the left side of the fuse cover up from the power inlet assembly, using a small flat-blade screwdriver. The fuse cover is hinged on the right and will remain attached to the analyzer. Each fuse is housed in a separate, removable carrier.
3. Remove a fuse carrier by lifting it from the power inlet housing using your fingers. Avoid using sharp instruments to lift the carriers holding the fuses.
4. Replace the fuse in the carrier with one of the same amperage and voltage ratings.
5. Reinstall the fuse carrier into the power inlet module, ensuring that the arrows on the ends of the fuse carriers point up.
6. Close the fuse cover until it snaps into place.
7. Reconnect the power cord, and power on the analyzer if desired.

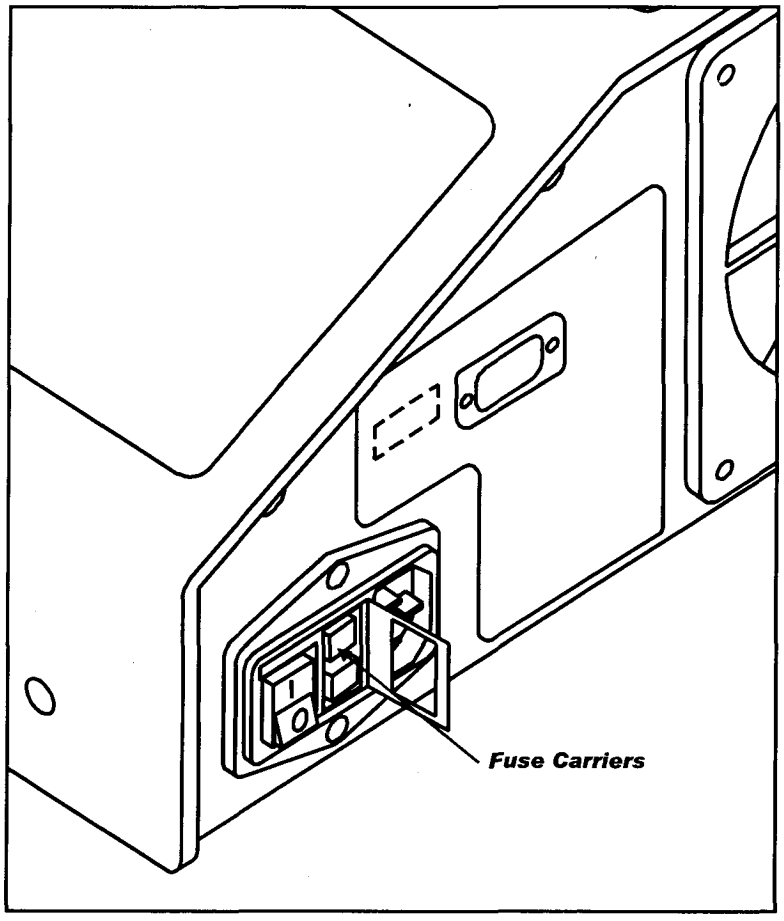


Figure 4-1. Diagram of the Fuse Cover.

Ventilation

The Model 402A requires proper ventilation so that it does not overheat during operation. Always ensure that the two ventilation ports, one located on each side of the analyzer, are not blocked during use. Maintain at least four inches (10.2 centimeters) of clear space around each of these ports.

An internal fan located immediately behind the grille on the left side port supplies forced-air ventilation. Temperature sensors measure how hot the load resistors are. The fan accelerates as the load temperature increases. The fan rotation is monitored too. If the load temperature is excessive or if the fan is not functioning, an error condition is indicated on the display and the audio transducer emits a beeping sound. The error display codes are:

E 01: Temperature too high.
E 02: Fan not operating.

CAUTION

Permanent damage to the Model 402A can occur if you continue to apply a high-level ESU signal after the alert has been activated.

Connecting Test Leads between the ESU and the Analyzer

A complete set of test leads is supplied with the analyzer. These test leads are used to connect the ESU generator output to the analyzer and to configure the analyzer to conduct a specific ESU test. The supplied test leads are designed using the shrouded safety 4-mm banana plugs and when required the special-purpose 2-PIN contact quality monitor (CQM) connector to facilitate the safe connection to ESU including the neutral (or dispersive) electrode. The following is a description of the supplied test leads:

ESU- Active Safety Lead

DNI Part # 3010-0579
Color: Yellow
Quantity: One

One end of test lead has a fixed shroud 4mm banana plug to connect with the analyzer and the other end has a retractable shroud 4mm banana plug compatible with the active electrode/bipolar jacks on most ESU front panels. A yellow safety alligator clip is included to directly connect to an actual active electrode element if you desire.

ESU- Dispersive Safety Lead

DNI Part #: 3010-0576
Color: Blue
Quantity: One

One end of test lead has a single fixed-shroud 4mm banana plug to connect with the analyzer and the other end has a CQM style 2PIN connector which will plug directly into the neutral (or dispersive) electrode jack on most ESU front panels.

Note

The mechanical pin is removed from the CQM connector to disable CQM during ESU generator output tests.

ESU Jumper Safety Lead

DNI Part # 3010-0578
Color: Black
Quantity: Two

Both ends of these two short jumpers have a fixed shroud 4mm banana plug and are used to configure the analyzer for the IEC Type BF Tests 1 & 2 which utilize the auxiliary HF load resistance (200Ω). Both jumpers are required to conduct these tests. One of these short jumpers is used to configure the analyzer for the IEC Type CF/Bipolar and ANSI/AAMI HF leakage tests.

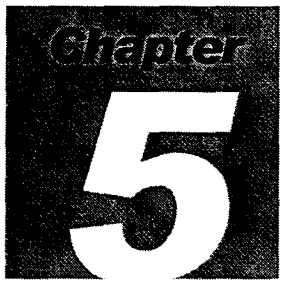
ESU CQM Safety Lead

DNI Part # 3010-0575
Color: Clear/Blue
Quantity: One

One end of test lead has two fixed shroud 4mm banana plugs to connect across the analyzer test load. The other end has a CQM style 2PIN connector that will plug directly into the neutral (or dispersive) electrode jack on most ESU front panels.

Note

The mechanical pin is intact to enable the CQM function during this resistance test.



Manual Operation

Use this chapter to learn how to use your Model 402A for testing electrosurgical units.

Safety Precautions

When testing electrosurgical units, particular safety precautions should be observed both to ensure operator safety and to maintain the integrity of the high frequency (HF) measurement. To perform the desired surgical effect, the signals from these devices are both high-voltage and high frequency in nature and require special handling by the operator.

- Place the analyzer on an insulated, non-conductive work surface to limit possible HF current paths to earth ground.
- Use the test leads supplied with the analyzer to test the ESU. These test leads are designed to the IEC-1010 safety standard and utilize a shrouded 4mm plug to limit exposure to the high-voltage and high frequency ESU signal. These test leads are one meter in length to limit the coupling of the ESU signal to earth ground. Routinely inspect the test leads for wear and tear. Repair or replace the test leads to maintain operator safety and analyzer performance.
- Whenever practical during testing, activate the ESU generator output using the foot switch supplied with the ESU. Disposable handpieces, employed during surgical procedures to activate the CUT & COAG signals, will degrade over time since they were are not intended for long-term use. Erroneously high HF leakage measurements can also be encountered due to their long length if draped across conductive surfaces.
- Whenever practical during testing, place test leads carrying the ESU signals in parallel, approximately 0.5 meters apart, to limit capacitive coupling. Also, avoid crossing or tangling the test leads during use and do not drape the test leads across any conductive, grounded surfaces.

WARNING!

Do not plug in or remove a test lead from either the ESU or the analyzer while the ESU generator is activated (or keyed). This high frequency ESU signal can be several thousand volts in amplitude when the output is open-circuited. **Severe burning or possible cutting of the skin can occur** if you do not adhere to safe ESU equipment testing techniques.

- You can clean your Model 402A using a mild solution of detergent and water **only**. Moisten a clean cloth with this solution and wipe clean.

CAUTION

Using any other solutions to clean your Model 402A could result in damage to the analyzer.

Performing Manual Tests

The sections that follow describe the specific ESU tests you can perform using the Model 402A. Test procedures prompt you to manually connect test leads in the required configuration. The Model 402A does not internally configure the test connections. You can view functional-block diagrams for each test on the Model 402A's top panel, as well as at the end of each test procedure section in this chapter. You can find additional information about test leads in Chapter 4, Installation.

Note

The Model 402A can test a wide range of electrosurgical units for basic operation and performance. It is compatible with both isolated and earth–ground referenced outputs and with both monopolar and bipolar outputs. If you have any questions about testing an ESU, you can review Chapter 2, *Specifications* and the technical service manual for the ESU you want to test. In addition, you can contact DNI Nevada, Incorporated or your DNI sales representative for additional assistance.

Performing the Generator Output Test

The analyzer provides an effective method of attaching a resistive test load to the ESU under test and will display the output directly in either watts or HF current of the applied ESU signal. See Figure 5-1 for a diagram of the generator output test at the end of this section.

Test Procedures

This test involves:

1. Connecting the ESU you want to test to the Model 402A.
2. Selecting a test load resistance.
3. Measuring the ESU's generator output in watts.
4. Measuring the ESU's generator output in current.
5. Ending the test.

To connect the ESU to the Model 402A:

1. Connect ESU Active/Bipolar-1 electrode to the yellow jack #1, using DNI Test Lead Part # 3010-0579.
2. Connect ESU Neutral/Dispersive/Bipolar-2 electrode to the blue jack #2, using DNI Test Lead Part # 3010-0576.

Note

The bipolar outputs on some ESUs may require different test leads to make both connections to the Model 402A.

Note

Some general purpose electrocoagulation units designed for office-based procedures, such as the ConMed® Hyfrecator *Plus*® Model 7-797, have only one apparent monopolar output electrode. Since the monopolar output neutral electrode of the Model 7-797 is internally earth referenced through the power cord, the ESU must be connected to the Model 402A in a different manner. To test this device, connect the monopolar active electrode handpiece to the yellow jack #1 and place the supplied jumper from the blue jack #2 to either earth connection green jack #3 or #4. Generator output measurements can now be conducted.

To select the desired test load resistance:

1. If the power indicator lamp on the front panel is illuminated, go to Step 2. If it is not illuminated, press the **Measurement Select** button located on the top panel and go to Step 2.

2. On the front panel, push the Increase or Decrease buttons until the test load value you want appears in the display. After approximately one (1) second, the display is blank. Below is an example of a test load value as it appears in the display.

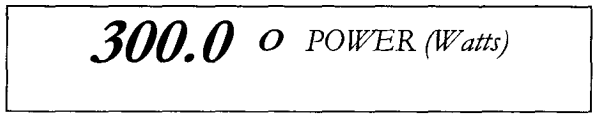
Δ(INCREASE) ∇(DECREASE)

Note

The default (or initial power-up) test load selection is 300 ohms.

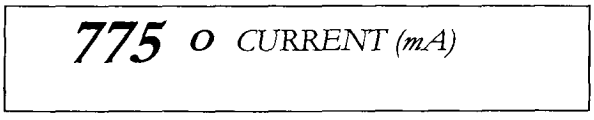
To measure the ESU's generator output in watts:

Activate the ESU and view the power measurement on the display. Here is an example.



To measure the ESU's generator output in current:

1. While the ESU is still activated, press **Measurement Select** on the front panel. The current indicator lamp will light.
2. View the ESU's generator output (in mA). Below is an example.



To end the generator output test:

Deactivate the ESU to end the generator output test.

CAUTION

Do not exceed the Model 402A's duty cycle which is 30 seconds on during any continuous one-minute period at the maximum ESU output levels (300w-400w).

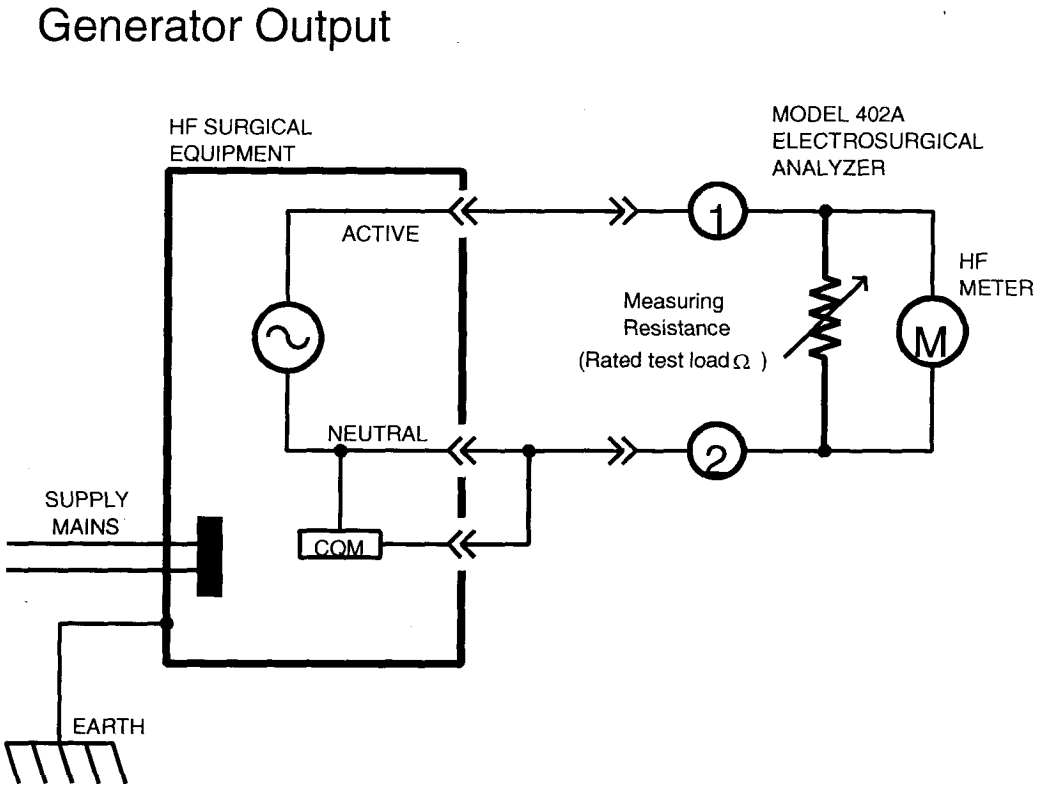


Figure 5-1. Diagram of the Generator Output Test.

Performing the HF Leakage Current Test 1

The HF leakage test number one (1) is an IEC earth referenced, BF type, HF leakage test. You perform the test by connecting the auxiliary HF load resistance (200 ohms) across the ESU's monopolar output. High frequency leakage current is then measured from the neutral/dispersive electrode to the earth ground reference through the measuring resistance set at 200 ohms and the HF meter. You can view the resulting measurement on the Model 402A's display. See Figure 5-2 for a diagram of this test at the end of this section.

Test Procedures

The procedures involved with this test include:

1. Connecting the ESU you want to test to the Model 402A.
2. Selecting a 200-ohm test load resistance.
3. Measuring the ESU's HF leakage current.
4. Ending the test.

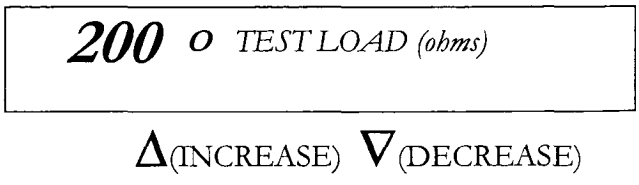
To connect the ESU to the Model 402A:

1. Connect the ESU Active electrode to gray jack #7, using DNI Test Lead Part # 3010-0579.
2. Connect the ESU Neutral/Dispersive electrode to blue jack #2, using DNI Test Lead Part # 3010-0576.
3. Connect a jumper between yellow jack #1 and green jack #4, using DNI Test Lead Part # 3010-0578.
4. Connect a jumper between blue jack #3 and gray jack #6, using DNI Test Lead Part # 3010-0578.

To select a 200-ohm test load resistance setting:

1. If the power indicator lamp on the front panel is illuminated, go to Step 2. If it is not illuminated, press the **Measurement Select** button located on the top panel and go to Step 2.

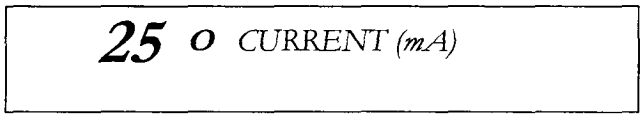
2. On the front panel, push the increase button repeatedly until the test load value 200 appears in the display. After approximately one (1) second, the display is blank. Below is an example of a test load value as it appears in the display.



To measure the ESU's signal HF leakage:

1. If the power indicator lamp on the front panel is illuminated, go to Step 2. If it is not illuminated, press the **Measurement Select** button located on the top panel and go to Step 2.

2. Activate the ESU and view the signal HF leakage measurement on the display. The measurement will be in millamperes. Here is an example.



To end HF leakage test number one:

Deactivate the ESU to end the generator output test.

CAUTION

Do not exceed the Model 402A's duty cycle which is 30 seconds on during any continuous one-minute period at the maximum ESU output levels (300w-400w).

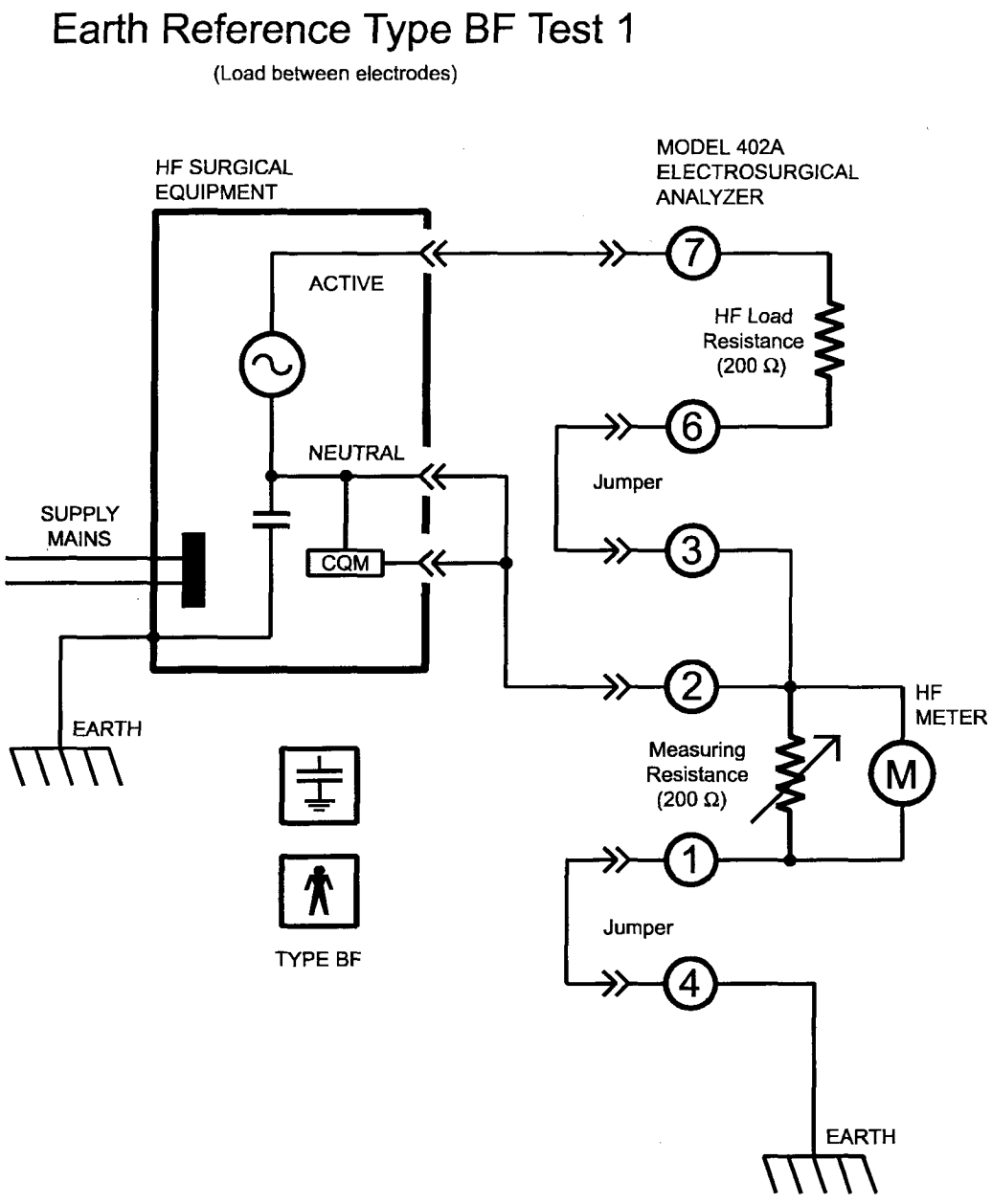


Figure 5-2. Diagram of HF Leakage Test Number One.

Performing the HF Leakage Current Test 2

The HF leakage test number two (2) is an IEC earth-referenced, BF-type, HF leakage current test. You perform the test by connecting the auxiliary 200-ohm HF load resistance from the ESU's active electrode to earth/ground on the Model 402A. Then you connect the measuring resistance/HF meter 200-ohm test load from the ESU's neutral/dispersive electrode to earth/ground on the Model 402A. The Model 402A then displays the high frequency current leakage from the ESU you're testing. See Figure 5-3 for a diagram of this test at the end of this section.

Test Procedures

The procedures involved with this test include:

1. Connecting the ESU you want to test to the Model 402A.
2. Selecting a 200-ohm test load resistance.
3. Measuring the ESU's HF leakage current.
4. Ending the test.

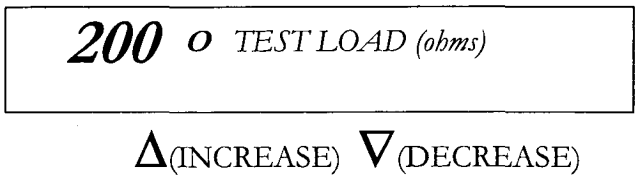
To connect the ESU to the Model 402A:

1. Connect the ESU Active electrode to gray jack #7, using DNI Test Lead Part # 3010-0579.
2. Connect the ESU Neutral/Dispersive electrode to yellow jack #1, using DNI Test Lead Part # 3010-0576.
3. Connect a jumper between blue jack #3 and green jack #4, using DNI Test Lead Part # 3010-0578.
4. Connect a jumper between green jack #5 and gray jack #6, using DNI Test Lead Part # 3010-0578.

To select a 200-ohm test load resistance setting:

1. If the power indicator lamp on the front panel is illuminated, go to Step 2. If it is not illuminated, press the **Measurement Select** button located on the top panel and go to Step 2.

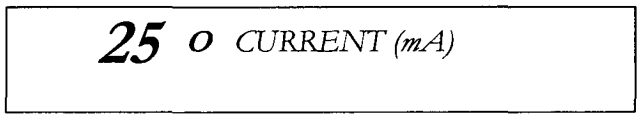
2. On the front panel, push the Increase or Decrease as needed until the test load value 200 appears in the display. After approximately one (1) second, the display is blank. Below is an example of a test load value as it appears in the display.



To measure the ESU's signal HF leakage:

1. If the power indicator lamp on the front panel is illuminated, go to Step 2. If it is not illuminated, press the **Measurement Select** button located on the top panel and go to Step 2.

2. Activate the ESU and view the signal HF leakage measurement on the display. The measurement will be in millamperes. Here is an example.



To end HF leakage test number two:

Deactivate the ESU to end the generator output test.

CAUTION

Do not exceed the Model 402A's duty cycle which is 30 seconds on during any continuous one-minute period at the maximum ESU output levels (300w-400w).

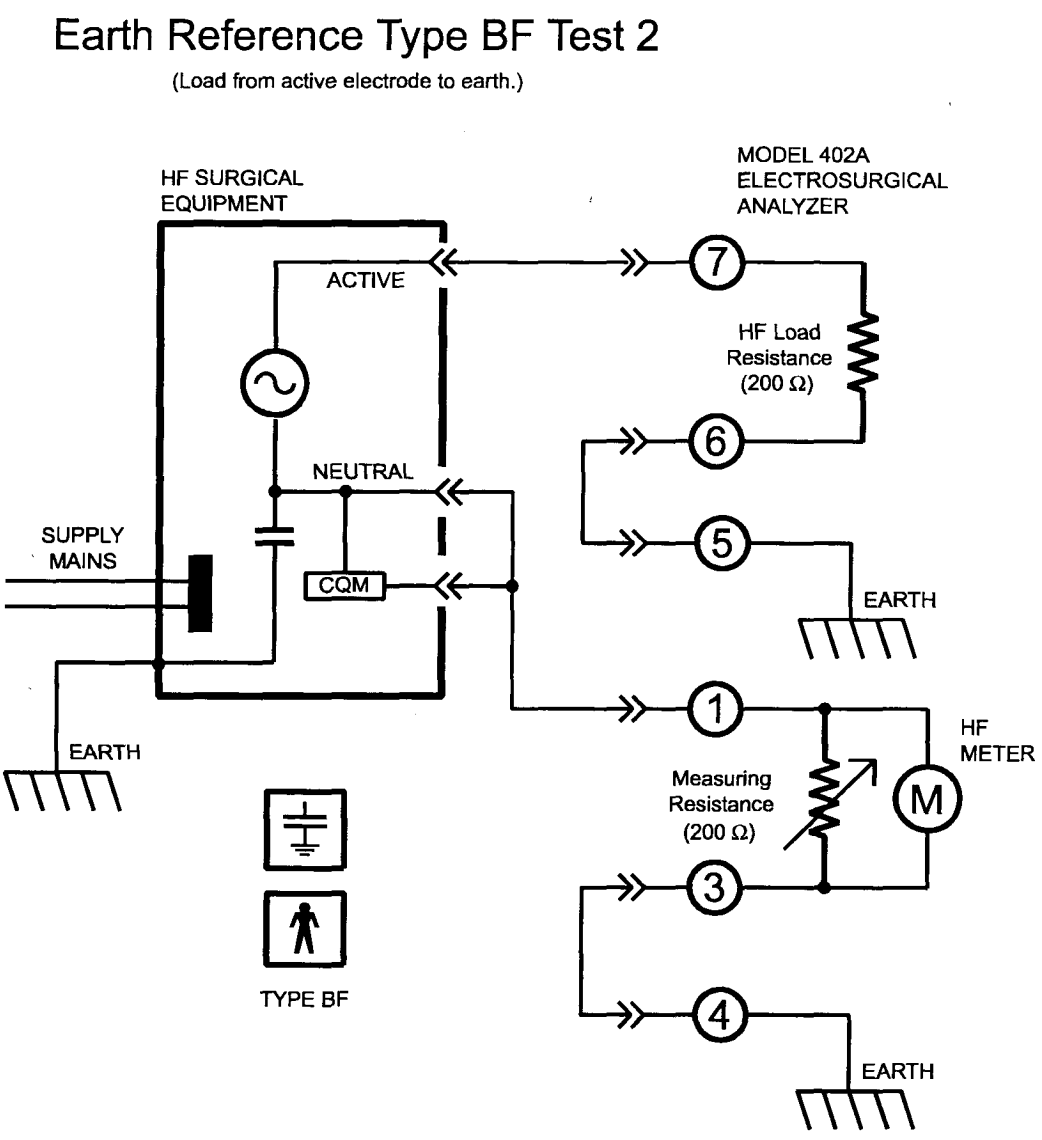


Figure 5-3. Diagram of HF Leakage Test Number Two.

Performing the HF Leakage Current Test 3

The HF leakage current test number three (3) is an IEC-ANSI/AAMI isolated output/bipolar, CF-type, HF leakage current test. It shows you the amount of open-circuit high frequency current leakage from a single isolated electrode to earth/ground through the 200-ohm measuring resistance test load and HF meter. See Figure 5-4 for a diagram of this test at the end of this section.

Note

This high frequency leakage current test is intended for isolated output electrosurgical units only. If you test the active electrode of an earth-referenced, Type BF ESU in the manner described in this section, you will be measuring the full output of the generator, not a high frequency leakage current. While conducting this test inappropriately will not damage the Model 402A, the resulting high frequency leakage current measurement will not be valid for an earth/ground referenced ESU.

Test Procedures

The procedures involved with this test include:

1. Connecting the ESU electrode you want to test to the Model 402A.
2. Selecting a 200-ohm test load resistance.
3. Measuring the ESU's HF leakage current.
4. Ending the test.

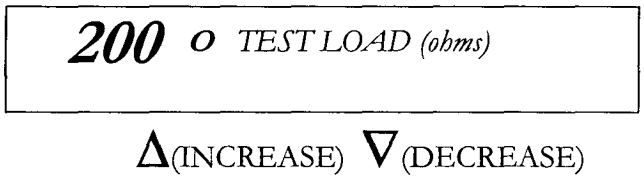
To connect the ESU electrode to the Model 402A:

1. If you are testing the ESU's active or single bipolar electrode, connect the electrode to yellow jack #1, using DNI Test Lead Part # 3010-0579, **or**
   If you are testing the ESU's neutral/dispersive electrode, connect that electrode to yellow jack #1, using DNI Test Lead Part # 3010-0576.
2. Connect the jumper between the blue jack #3 and the green jack #4, using DNI Test Lead Part # 3010-0578.

To select a 200-ohm test load resistance setting:

1. If the power indicator lamp on the front panel is illuminated, go to Step 2. If it is not illuminated, press the Measurement Select button located on the top panel and go to Step 2.

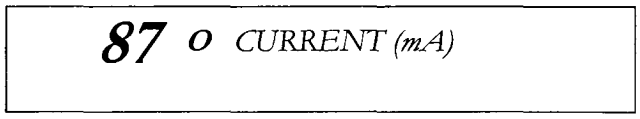
2. On the front panel, push the increase or decrease as needed until the test load value 200 appears in the display. After approximately one (1) second, the display is blank. Below is an example of a test load value as it appears in the display.



To measure the ESU's signal HF leakage:

1. If the power indicator lamp on the front panel is illuminated, go to Step 2. If it is not illuminated, press the **Measurement Select** button located on the top panel and go to Step 2.

2. Activate the ESU and view the signal HF leakage measurement on the display. The measurement will be in millamperes. Here is an example.



To end HF leakage test number two:

Deactivate the ESU to end the generator output test.

CAUTION

Do not exceed the Model 402A's duty cycle which is 30 seconds on during any continuous one-minute period at the maximum ESU output levels (300w-400w).

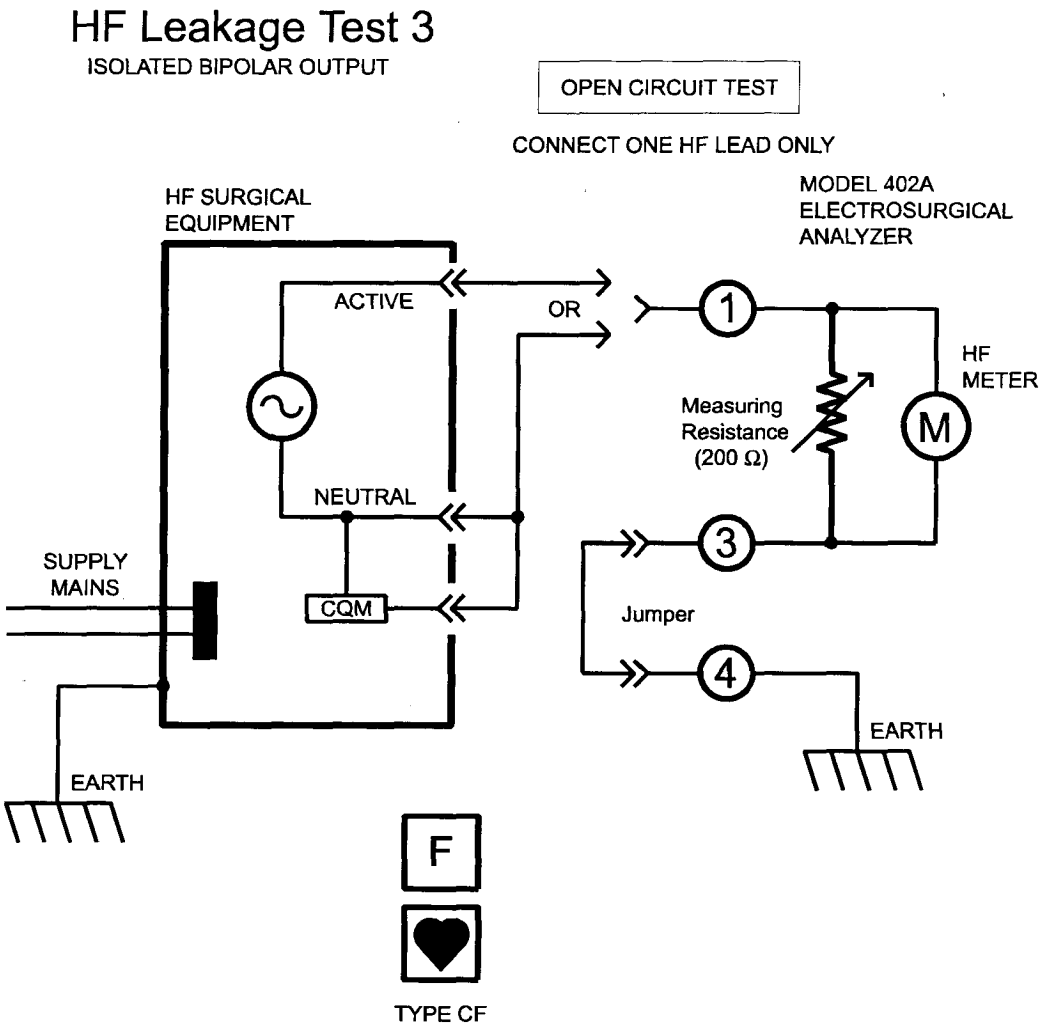


Figure 5-4. Diagram of HF Leakage Test Number Three.

Performing the Basic Contact Quality Monitor (CQM) Test

This test of the contact quality monitor uses the Model 402A's test load to simulate a patient's skin resistance in contact with the dual element neutral/dispersive electrode pad.

Note

Perform this test on electrosurgical units without energizing the generator output. Do not connect the ESU active electrode to the Model 402A during this test.

The CQM test is intended for the neutral/dispersive electrode of monopolar ESUs equipped with a contact quality monitor. The neutral/dispersive electrode is actually two separate pads attached to the patient's skin. The CQM circuit should issue an alarm only if the patient loses contact with one or both of the two pads. See Figure 5-5 for a diagram at the end of this section.

Test Procedures

The procedures involved with this test include:

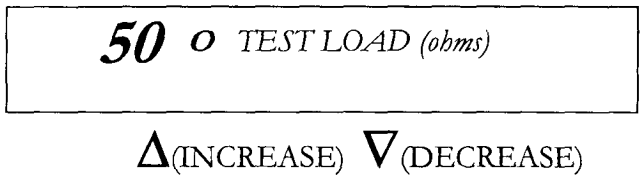
1. Connecting the ESU's neutral/dispersive electrode to the Model 402A.
2. Selecting a 50-ohm test load resistance.
3. Observing the ESU's visual or audio alarm.

To connect the ESU's neutral/dispersive electrode to the Model 402A:

1. Connect one of the two (2) color-coded banana plugs (DNI Test Lead Part # 3010-0575) to the Model 402A's yellow jack #1.
2. Connect the other banana plug to the Model 402A's blue jack #2.
3. Connect the 2 PIN CQM connector on the other end of the test lead to the neutral/dispersive electrode of the ESU.

To select a 50-ohm test load resistance setting:

1. If the power indicator lamp on the front panel is illuminated, go to Step 2. If it is not illuminated, press the **Measurement Select** button located on the top panel and go to Step 2.
2. On the front panel, push the Increase or Decrease as needed until the test load value 50 appears in the display. After approximately one (1) second, the display is blank. Below is an example of a test load value as it appears in the display.



To observe the ESU's visual or audible alarm:

With the 50-ohm test load attached to the ESU CQM input, it should sense this level of resistance in the "pass zone". Depending upon the ESU device manufacturer, this "pass zone" can extend to 250 ohms. Test load settings over 250 ohms should activate the CQM alarm.

Note

Refer to the technical support/service manual of the ESU you are testing for the recommended check-out procedure for the ESU CQM feature.

Increase the test load from 50 ohms until the CQM alarm sounds. The value at that point is the approximate CQM alarm resistance.

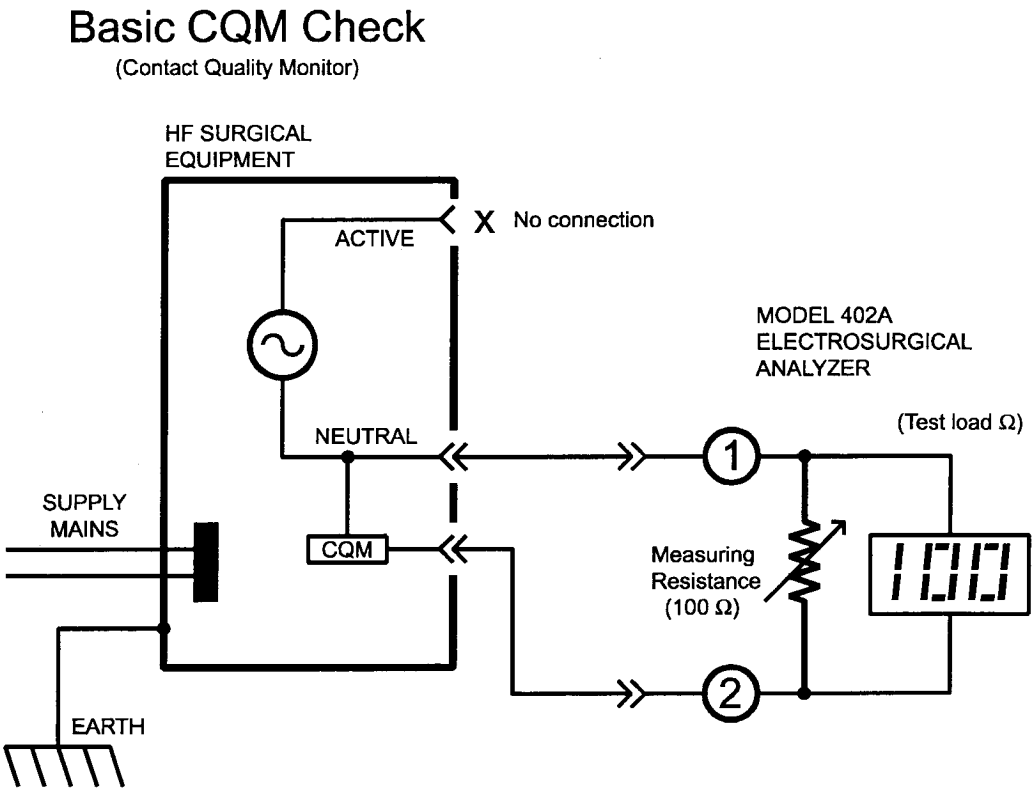


Figure 5-5. Diagram of the Basic CQM Check.

Connecting an Oscilloscope to the Model 402A

You can connect an oscilloscope to the Model 402A. Connect a standard coaxial cable to the **Scope Output** BNC connector located on the left side of the top panel. Adjust your oscilloscope in order to view the applied waveform. Look at Figure 5-6 to see a typical "burst" waveform.

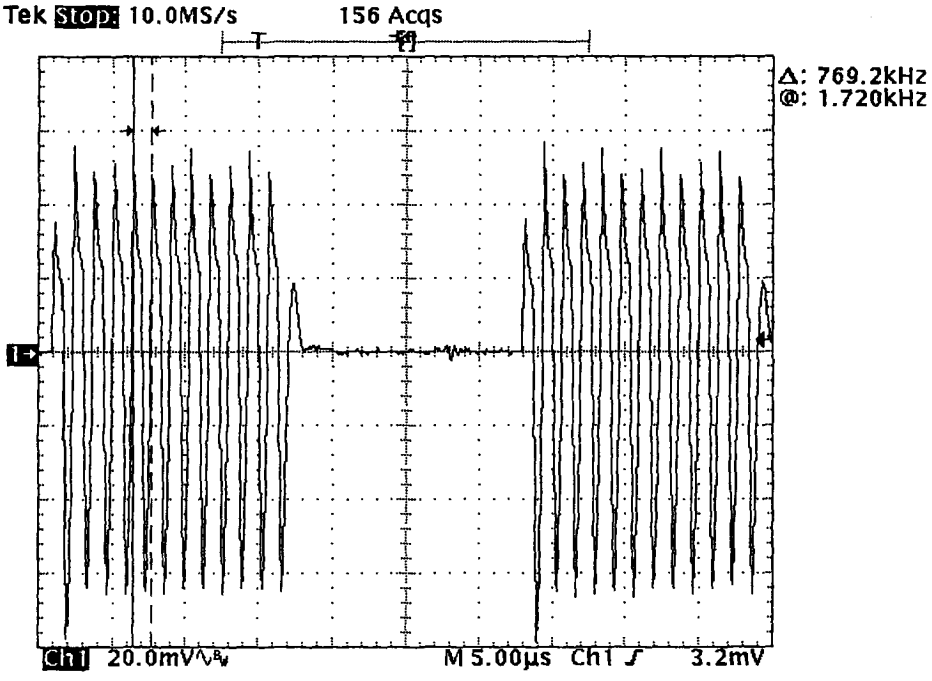
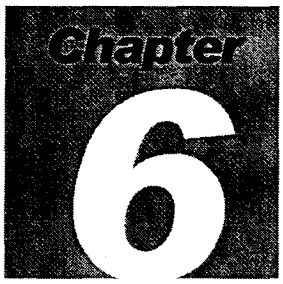


Figure 5-6. Example *Burst* Waveform on an Oscilloscope Display.



Remote Operation

Use this chapter to learn how to remotely use your Model 402A from the serial port for testing electrosurgical units.

You can operate the Model 402A locally or remotely. Local mode is the default, by which you manually control the analyzer by pressing the buttons on the front panel. You set the test load you want, then you indicate whether you want to measure watts or current. All test load and measurement values appear on the display. Two remote operation modes are available, including:

Simplex Mode: In this mode, you control operation of the Model 402A from the keypad. Data is sent to a host device at a fixed baud rate. Hosts include serial printers, compatible terminal devices, personal computers, and DNI Nevada's medTester 6000. In the simplex mode, the Model 402A can not receive commands or data from a remote terminal or computer.

Duplex Mode: In the duplex mode, you input commands to the Model 402A and view data output from the Model 402A at a remote terminal or computer. In addition, you can use DNI Nevada's medTester 5000C to control the Model 402A for performing preprogrammed and custom ESU autosequences.

Both the simplex and duplex modes of remote operation are described in this chapter.

Simplex Mode

In the simplex mode, you control operation of the Model 402A from the keypad. By pressing the Measurement Select button, you can transmit a fixed data string to a host device that includes the test load value (in ohms), ESU readings (in watts), and HF current (in milliamperes) to a "host device". A host device can be a serial printer, a personal computer or other compatible terminal, or DNI Nevada's medTester 6000 Electrical Safety Analyzer. Suitable host devices include:

- Compatible serial printer,
- Personal computer or other compatible terminal, or
- medTester 6000 Electrical Safety Analyzer.

Note

With the medTester 6000, ESU test data is appended to the Comments field of the electrical safety autosequence test record. Data are stored in the test record which you can print.

To set up and operate the Model 402A in simplex mode:

1. Connect the Model 402A to the device with the applicable serial interface cable.
   (See the table on page 48).
2. With the Model 402A power turned off, press and hold both the Increase and Decrease test load buttons, located on the front panel.
3. Power on the Model 402A, and then release both the Increase and Decrease test load buttons.
4. Set up the Model 402A to conduct the desired ESU measurement as described in Chapter 5, *Manual Operation.*
5. Press and release the Measurement Select button to transmit data. Data is then transferred in the format: **Watts**=XXX.X, **I**=YYYY, **Load**=ZZZ.
6. To exit simplex mode, press and release both the Increase and Decrease test load buttons, or
   Power off the Model 402A.

Transferred measurements appear in units of watts, milliamperes, and ohms.

If you're transferring ESU test data to a medTester 6000, a sample test record is on the next page.

Serial Interface Cables

If you want to connect the Model 402A to a host device using a DNI Nevada cable, use one of these as appropriate:

DNI NEVADA SERIAL INTERFACE CABLES		
For...	Use This Cable Description	Part Number
medTester 5000C to Model 402A, or	DB9 Female to DB25 Female	3010-0441

Personal Computer to Model 402A		
medTester 6000 to Model 402A, or Personal Computer to Model 402A	DB9 Female to DB9 Female (null modem)	3010–0585

Sample ESU test record as it appears in the medTester 6000 after being received from the Model 402A.

```
DNI NEVADA INC.                DATE: 06-26-98 TIME:
15:38:37
TECHNICIAN      : MCB                    TEST DATE :
     06-26-98
CONTROL#        : A-123831               PROCEDURE ID
     :
SERIAL #        : 12238909               LOCATION
     : OR#12
DEVICE TYPE     : ESU                    MANUFACTURER
     : ASPEN
ECG/LEADS       : 2
IEC 601-1 TEST Class I, Type CF

Line Voltage [V]
     L1 - EARTH              118.9
     L2 - EARTH              0.5
     L1 - L2                 119.0
Protective Earth Resistance    [Ohm]
                        0.077      [0.200] (Test
Current 25A)
Insulation Resistance
     L1, L2-CASE             OVER [20]
Applied Part Insulation
     All-CASE                OVER [50]
Current Consumption            [A]
                        0.4
Earth Leakage Current          [uA]
          Norm POL              103.6      [ 500]
           No L2                206.0      [ 500]
          REV POL               102.7      [ 500]
      NO L2             205.5       [1000]
Enclosure Leakage Current           [uA]
     NORM POL           0.0   [100]
      NO L2             0.0   [500]
      NO EARTH          103.4       [500]
     Rev POL            0.0   [100]
      NO L2             0.0   [500]
      NO EARTH          102.7       [500]
Patient Leakage Current             [uA]
     NORM POL           0.0   [10]
      NO L2             0.0   [50]
      NO EARTH          17.9  [50]
     Rev POL            0.0   [10]
      NO L2             0.0   [50]
      NO EARTH          19.1  [50]
Mains on Applied Part               [uA] (Norm Pol)
     ISOLATION POL.
```

medTester 5000C Autosequence Operation

You can operate the Model 402A in the duplex remote mode from a medTester 5000C that has the ESU autosequence module installed. After connecting the Model 402A to the ESU you want to test, you then connect the medTester to the Model 402A and begin a safety and performance autosequence. The autosequence prompts the Model 402A to set up and execute all tests that are preprogrammed into the autosequence. All setup commands, such as the power setting, along with all subsequent test measurements are transmitted from the Model 402A to the medTester where they are stored in test records.

To see an example of an ESU autosequence test record, go to page 60

medTester ESU Autosequences Used with the Model 402A

The medTester 5000C ESU module consists of autosequences that were originally designed for use with the DNI Nevada Model 454A ESU analyzer. Because the Model 402A does not have all the capabilities of the Model 454A, one of these autosequences—A63—can't be used as is with the Model 402A. The A63 autosequence is specifically designed for the ValleyLab Model Force 4B and uses return fault tests specific to that ESU, tests that are unavailable in the Model 402A. However, you can use the remaining four ESU autosequences as is with the Model 402A. Customize the A63, as you would the five blank ESU autosequences (A65-A69), to fit any ESU in your inventory.

Note

Always customize an autosequence with tests that exist within the Model 402A. If you attempt to tests that are incompatible with the Model 402A, that particular test will not be executed and the entire autosequence will abort.

Use this table (along with your medTester 5000C Operating Manual) to help you program ESU autosequences that are compatible with the Model 402A. The word "All" means that every value that appears on the medTester 5000C display when you're customizing an autosequence is compatible with the Model 402A

MODEL 402A ESU AUTOSEQUENCE TESTS
(That can be included in customized ESU autosequences.)

Generator Output Tests	RF (HF) Leakage	Contact Quality Monitor (CQM)
• Use the INTERNAL TEST LOAD selections only. • Use TESTLOADS between 50 and 750 ohms in 50 ohm steps only. • ALL other tests (or autosequence selections) are available in the Model 402A.	• The Model 402A performs an open circuit ANSI/AAMI HF leakage current (ISOLATED or BIPOLAR) test only. No closed circuit tests are available. • The Model 402A will automatically select the specified 200 ohm test load for all HF leakage tests. • ALL other autosequence selections are available using the Model 402A.	• The Model 402A will run the CQM test using the available main test load settings only. • This test can be run several times during an autosequence in order to document the basic operation of the ESU's CQM.
		Return Fault (ValleyLab Force-4B)
		• No return fault testing is available using the Model 402A.

Be sure to consult your medTester 5000C Operating Manual to learn how to run ESU autosequences using the Model 402A.

Guidelines for Using the Model 402A with Autosequences

Always follow these guidelines for running medTester 5000C ESU autosequences with your Model 402A:

- Use the supplied test leads to configure the Model 402A for the specific test to be performed in the autosequence.
- Measurements for this test shall appear on the medTester 5000C display only. The Model 402A numeric will have four (4) horizontal bars across it. When test results appear on the medTester 5000C display during each generator output or HF leakage test, simply press the F5 "HOLD" to freeze the updating of the current reading.

Guidelines for Using the Generator Output Tests

- Both the power output in watts and the current in milliamperes will be documented for each test step. Additionally, the preprogrammed test load selection will also be printed for each generator output test.
- Since the Model 402A does not have peak voltage (closed circuit) and crest factor measurement capabilities, each of these two blocks will have a default entry of X.XX. Note that peak voltage (closed circuit) and crest factor measurements are features exclusive to the earlier Model 454A.

Guidelines for Using RF (HF) Leakage Tests

- Connect the desired ESU electrode (active, neutral/dispersive. or bipolar) to the Model 402A top panel jacks using the supplied test leads.
- The two green safety jacks on the Model 402A top panel are ground/earth references for the RF (HF) leakage test.

Guidelines for Using CQM Tests

- Use the supplied CQM test lead to configure the Model 402A for this test to be performed in the autosequence.
- The Model 402A main test load is used for this basic CQM test and a starting value of 100 ohms is preset to initiate the test.
- During the CQM test, the Model 402A is briefly returned to LOCAL operation. Now you can push the front pane INCREASE (or DECREASE) TEST LOAD pushbutton(s) until you reach the desired resistance value. The resistance value will be displayed on the Model 402A.
- Press F5 READ on the medTester 5000C to document the measurement.

A sample of a medTester 5000C ESU autosequence is on the next page.

Sample test record generated by a medTester 5000C, ESU autosequence, including a 16-step checklist.

```
MedTester Rec #1
SEQUENCE:       60      DATE: 06/26/50 TIME: 08:35:01
OP CODE:        MCB
DEVICE INFORMATION
        TYPE:   ESU     Manf:   Aspen Labs      LOC: OR#12
        Model:  Excalibur       SERIAL #:       12238909
        CN#:    A-123831
PHYSICAL INSPECTION
------------------------------------------------------------------------
STEP 1: Generator Output 300 OHMS MONOPOLAR PURE CUT
 POWER SETTING 120      EXPECTED POWER 120 W LIMITS +/- 15%
 POWER= 124.8 W         VPP= X.XX       CF= XX.X        CURRENT= 645 mA
STEP 2: Generator Output 300 OHMS MONOPOLAR PURE CUT
 POWER SETTING 300      EXPECTED POWER 300 W LIMITS +/- 15%
 POWER= 295.2 W         VPP= X.XX       CF= XX.X        CURRENT= 992 mA
STEP 3: Generator Output 300 OHMS MONOPOLAR BLEND 1
 POWER SETTING 69       EXPECTED POWER 69 W LIMITS +/- 15%
 POWER= 76.2 W VPP= X.XX        CF= XX.X        CURRENT= 504 mA
STEP 4: Generator Output 300 OHMS MONOPOLAR BLEND 1
 POWER SETTING 180      EXPECTED POWER 180 W LIMITS +/- 15%
 POWER= 171.5 W         VPP= X.XX       CF= XX.X        CURRENT= 756 mA
STEP 5: Generator Output 300 OHMS MONOCOAG STANDARD
 POWER SETTING 48       EXPECTED POWER 48 W LIMITS +/- 15%
 POWER= 045.6 W         VPP= X.XX       CF= XX.X        CURRENT= 390 mA
STEP 6: Generator Output 300 OHMS MONOCOAG STANDARD
 POWER SETTING 120      EXPECTED POWER 120 W LIMITS +/- 15%
 POWER= 113.8 W         VPP= X.XX       CF= XX.X        CURRENT= 616 mA
STEP 7: Generator Output 300 OHMS MONOCOAG SPRAY
 POWER SETTING 40       EXPECTED POWER 40 W LIMITS +/- 15%
 POWER= 039.3 W         VPP= X.XX       CF= XX.X        CURRENT= 362 mA
STEP 8: Generator Output 300 OHMS MONOCOAG SPRAY
 POWER SETTING 80       EXPECTED POWER 80 W LIMITS +/- 15%
 POWER= 078.0 W         VPP= X.XX       CF= XX.X        CURRENT= 510 mA
STEP 9: RF LEAKAGE LOAD OPEN MONOCOAG STANDARD
 POWER SETTING 120      ACTIVE ELECTRODE
 RF LEAKAGE= 0141
STEP 10: RF LEAKAGE LOAD OPEN MONOCOAG STANDARD
 POWER SETTING 120      DISPERSIVE ELECTRODE
 RF LEAKAGE= 0147
STEP 11: RF LEAKAGE LOAD OPEN MONOPOLAR PURE CUT
 POWER SETTING 120      ACTIVE ELECTRODE
 RF LEAKAGE= 0084
STEP 12: RF LEAKAGE LOAD OPEN MONOPOLAR PURE CUT
 POWER SETTING 300      DISPERSIVE ELECTRODE
 RF LEAKAGE= 0138
STEP 13: Generator Output 50 OHMS BIPOLAR COAG
 POWER SETTING 20       EXPECTED POWER 20 W LIMITS +/- 15%
 POWER= 020.7 W         VPP= X.XX       CF= XX.X        CURRENT= 644 mA
STEP 14: Generator Output 50 OHMS BIPOLAR COAG
 POWER SETTING 50       EXPECTED POWER 50 W LIMITS +/- 15%
 POWER= 049.8 W         VPP= X.XX       CF= XX.X        CURRENT= 998 mA
STEP 15: Generator Output 50 OHMS BIPOLAR CUT
 POWER SETTING 20       EXPECTED POWER 20 W LIMITS +/- 15%
 POWER= 023.4 W         VPP= X.XX       CF= XX.X        CURRENT= 684 mA
STEP 16: Generator Output 50 OHMS BIPOLAR CUT
 POWER SETTING 50       EXPECTED POWER 50 W LIMITS +/- 15%
 POWER= 051.1 W         VPP= X.XX       CF= XX.X        CURRENT= 1010 mA
COMMENTS:
NEXT TEST DUE DATE:  12/26/98
USER TIME:  HOURS
ELAPSED TEST TIME:  411 SECONDS
```

Index

A

accessories
- optional 10
- standard 9

D

duplex mode
- and medTester autosequences 57
- characteristics 52
- entering and exiting remote mode 52
- error responses to commands 54
- how to enter remote commands 53
- how to make a remote connection 51
- of remote operation 51
- primary remote command list 55
- responses to commands 53
- secondary remote command list 55

E

external fuses
- replacing 19

F

front panel
- layout 11

fuses 18
- external 19
- replacing 19
- internal 18

I

installation
- power-up sequence 16
- error codes 17
- setting up for operation 15
- ventilation 21

instrument familiarity
- front panel 11
- left panel 13
- right panel 13
- top panel 13

intended use
- statement of 2

internal fuse 18

internal fuses 19

L

layout
- front layout 11
- left layout 13
- right layout 13
- top layout 13

left panel
- layout 13

M

manual operation 25
- safety precautions 25

medTester 5000C sample ESU test record .. 60

medTester 6000 sample ESU test record 50

medTester autosequences
- and Model 402A tests used in 58
- and the Model 402A 57

Model 402A tests
- used in customized autosequences 58

O

oscilloscope
- connecting to the Model 402A 45

P

primary remote operation commands
- list of commands 55

procedures
- contact quality monitor (CQM) test 42
- generator output test 28
- HF leakage current test 1 32
- HF leakage current test 2 35
- HF leakage current test 3 38
- overview 27

R

reference documents
- for HF surgical equipment inspection 3

remote operation
- duplex mode 51
- duplex mode defined 47
- serial cables used with 49
- simplex mode 48
- simplex mode defined 47

remote operation commands
- error responses to commands (in medTester display) 54
- how to enter 53
- responses to commands (in medTester display) 53

right panel
- layout 13

S

safety considerations
labels and symbols 1
safety symbols and labels 1
secondary remote operation commands
list of commands 55
simplex mode
defined 47
of remote operation 48
setting up and operating 48
specifications
general 8
instrument 5
statement of intended use 2

T

test leads
connecting between ESU and Model 402A 22
ESU active safety 22
ESU CQM safety 23
ESU dispersive safety 22
ESU jumper safety 23
testing standards
met by the Model 402A 3
electromagentic interference 3
safety requirements 3
top panel
layout 13

U

using the manual 2

V

ventilation
required for proper operation 21